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CERTAIN OBSERVATIONS IN DRY-WIND REGIONS OF THE VOLGA RIVER,(U)
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FOREIGN TECHNOLOGY DIVISION

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OF THE VOLGA RIVER

by

P.A. Krylov

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EDITED TRANSLATION

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U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
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Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
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И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
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К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
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М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*<u>ye</u> initially, after vowels, and after ъ, ь; <u>e</u> elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

CERTAIN OBSERVATIONS IN DRY-WIND REGIONS OF THE VOLGA RIVER

P. A. Krylov

Results of studies on dry wind conducted in the Volga River region in 1952 and 1953 are reported.

After operations in the region of El'ton in 1951, it was recognized as being expedient to transfer the studies to one of the grain regions subjected to dry winds for the study there of characteristics of this phenomenon and the comparison of observations with data obtained in 1951. Many of the Volga River regions of the Saratov Oblast often and greatly suffer from dry winds. According to organization considerations, the station of such operations selected was one of the sovkhozes ("Makhorsovkhoz") in the Pugachev region of the Saratov Oblast. Observations in 1952 and 1953 were conducted on its territory. The station of observation was found near a large irrigated section and several windbreak forest belts (2-3-row with a height of 15-20 m and an age of about 15 years) and near a river (Bol'shoy Irgiz) and a forest massif behind the river.

It is well-known that the dry winds are most dangerous for the plantings in May and June. However, in virtue of circumstance, in 1952 and 1953 the operations had to be conducted only in the second half of the year. Then both of these years proved to be unusual with respect to conditions of weather in the summer period. With respect to the quantity of precipitation in summer months they were

greatly different from the perennial standard: it rained often; apparently, there was no dry wind in the first half of the wind. The variation of maximum diurnal temperatures and minimum relative humidity of the air for the second half of the summer in the period of observations (Fig. 1, 2) is given from recordings and readings of an aspiration psychrometer. A comparison with the other station of this region located at 10 km, in more severe conditions, and with the station in the region of Krasnyy Kut, located 100 km to the south, in still more severe conditions, revealed only an insignificant moderation of the variation in meteorological elements at our station of observations. The periods of the dry wind were determined from the approximate "standards" of the temperature and relative humidity of the air [1] and from a whole combination of indicators characteristic for the dry wind in these regions. Such dry wind periods were: 6-14 September 1952 and 29-30 August, 4-6 September, 13-14 September and 23-24 September 1953. Furthermore, there were groups of days which occupied by the number of indicators the intermediate position between the dry-wind and normal winds, for example, during 18-20 August 1952 and 1-8 August 1953. The origin of such intermediate groups is different. From the vast material of observations, it is necessary to distinguish here only the basic questions.

There is much interest in investigating differences in the content of air mixtures (finest dust) in normal conditions and in a dry-wind flow. To do this, an aspiration apparatus was used. At a height of 3 m the end of a rubber hose was attached to a special stand; the second end of the hose was connected through a laboratory gas counter to the aspirator (electrical vacuum cleaner). The aspirator drew the external air through the hose; the volume of air which was passed through was determined by the counter. In order to trap the "mist" suspended in the air, it was necessary to attach a filter to the upper end of the hose. Standard laboratory paper filters are not suitable for such purposes, since the pores, as is known [2], are larger than the particles suspended in the air ($<1\ \mu$). In 1952 the filter was a glass tube 13 cm long and 2 cm in diameter, filled compactly over the entire length with a tissue fabric wetted with glycerine. At the end of a working day the fabric was carefully

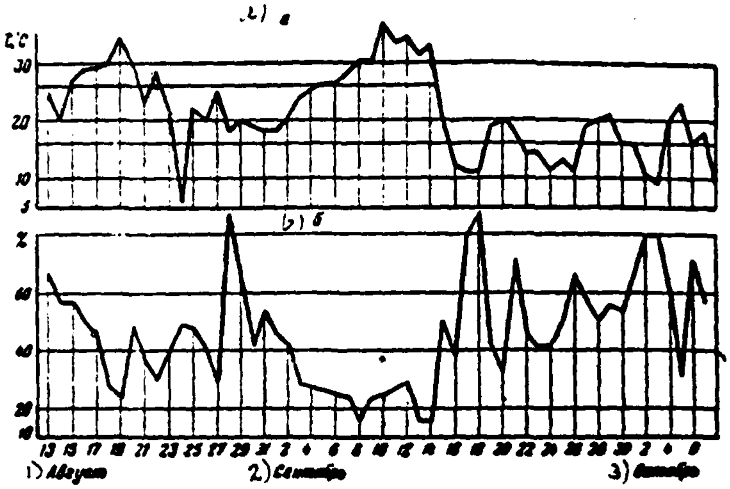


Fig. 1. Variation in temperature and relative humidity of the air in the Pugachev region from 13 August to 7 October 1952. a - maximum diurnal temperatures; b - minimum values of relative humidity. Key: 1) August; 2) September; 3) October.

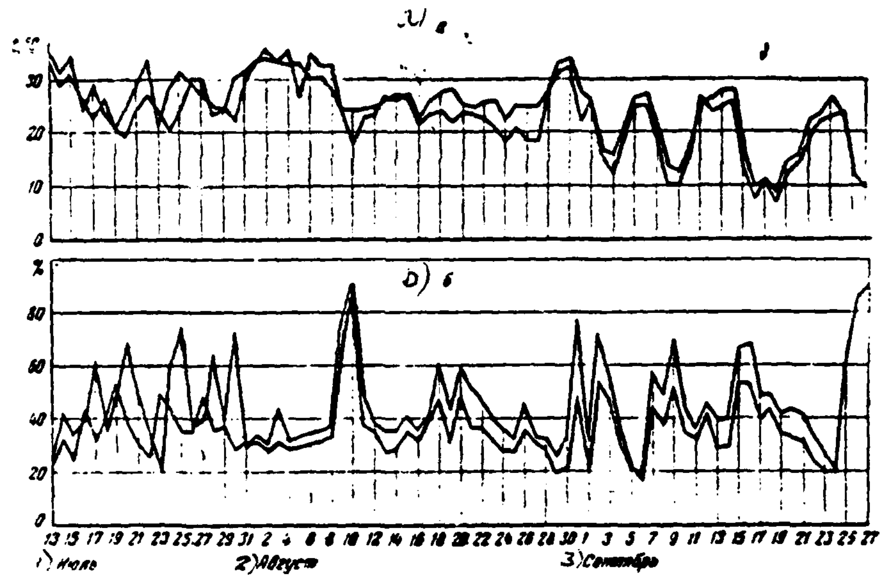


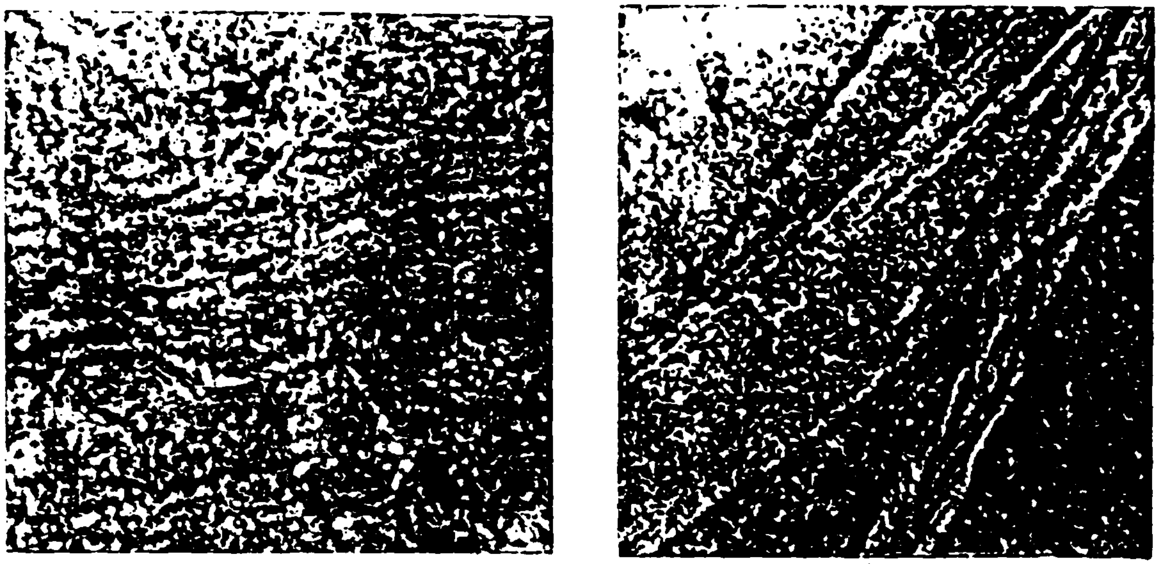
Fig. 2. Variation in temperature and relative humidity of the air in the Pugachev region from 13 July to 25 September 1953. a - maximum diurnal temperatures; lower line - main observation station; upper - second observation station; b - minimum values of relative humidity. Key: 1) July; 2) August; 3) September.

extracted and lowered into a container with distilled water; the covered container was sterilized in boiling water and then was sealed with parafin. Upon the return from the expedition, all the specimens were examined under a microscope, and the fabric was carefully washed

and removed from the containers. In all the containers pertaining to the dry-wind days, a considerable number of impurities, dozens of times more than on the remaining days, was revealed. After three months of sediment in the containers for the dry-wind days, gelatinous coagulates were distinguished from the transparent fluids; there were no coagulates in the remaining containers. Such filtrates during the dry-wind and intermediate days were combined and evaporated, and the residue (about 60 mg) was calcined. In 1953 a glass column, filled with 35-40 mm of pure glycerine, was used as the filter with the aspiration apparatus. Above the liquid in the column the aspirator created a rarefaction, and the external air along the other tube, reaching almost up to the bottom of the column, was directed with n, passing through a layer of liquid; in 10-15 min the operation of the apparatus in the column obtained a glycerine emulsion, through which external air passed in small drops. The apparatus operated usually for 6-8 h, and 8-10 m^3 of air passed through it.* After an operating day 10 cm^3 of ethyl alcohol was added to the liquid for sterilization of the solution, and the container was sealed with parafin. Later, in the laboratory distilled water of up to 60% concentration of glycerine was added to all the filters; the concentration of all solutions was checked with respect to the boiling point (109°). Then the specific gravity of the liquid in each container was determined in order to establish the increase in weight, which can be attributed only to impurities which entered into the filtrate from air. Obtained during 8 dry-wind days (reduced to the volume of 10 m^3 of air for each day) are 35 mg of air impurities; for 5 days of an intermediate nature - 3 mg; 16 normal days of August - 3 mg; 8 normal days of September - about 2 mg. On the average on a dry-wind day, the content of impurities in the air was thus 15-20 times more than that for a usual day. During one month in 1953 two aspiration apparatuses for mutual checking operated simultaneously. Both apparatuses gave matching results, except for two days, which on

*It is expedient to use a more powerful aspiration apparatus in order to be able to pass up to 50 m^3 of air per day. It would be necessary also to use a special electric filter for obtaining sediment in dry form. In 1953 such a filter was partially made, but it was not possible to put it into operation. The selection of glycerine for these purposes cannot be considered completely successful.

this principle were eliminated from the processing. It is necessary, however, to note that results of 1952 and 1953 are divergent: in 1952 sediments of 10 mg were obtained for 10 m^3 of air and in 1953, on the average of 5 mg of sediment. It makes not sense to give any explanation to this divergence without further studies. From solutions belonging to the dry-winds of 1953, after a prolonged sediment gelatinous coagulates were separated out (as in 1952). On photomicrographs (Fig. 3) it is noticed that the coagulate consists of chains of small particles connected by some transparent envelope. The particles suspended in air were, apparently, smaller, and on the photomicrographs products of their joining (coagulation) in the liquid are already evident. Later it was revealed that the water extract of the very upper layer of soil (dust) of one of the stations of El'ton region after a settling period of 35-40 days (i.e., when according to calculations of Stokes' formula in a suspended state in the liquid only particles less than 0.3 μ remain [3]) and decantation has an opalescent whitish-violet shading characteristic for dry-wind haze, and after two months separated from it are gelatinous coagulates floating in the liquid, and it has absolutely the same form as in filters during dry-wind days. In the same way the treated water extracts from soils of the station of observations and vicinities (up to 15 km) were slightly of brown color, did not have an opalescent shading and did not separate out coagulates. It would be useful, perhaps, to recall that the diameter of particles of the standard humid fog is about 10 μ; cement dust consists of particles of such dimensions; particles of tobacco smoke have a diameter of about 0.25 μ [4]. As it is possible to judge according to the approximate calculations and different indirect indices, particles of air impurities held by fillers are close in their dimensions to particles of tobacco smoke (0.3 μ and less). Calculations show that in 1 mg of substance there will be $1.5 \cdot 10^{10}$ of such particles. As a result of investigations of 1953, it was found that from 1 m^3 of air 0.5-0.8 mg of impurity are extracted; this means that in 1 mm^3 of air on individual days up to 7-10 particles were contained. However, even the complete external similarity of coagulates in the filtrates and in the settling from soils of the Caspian Sea region is still not direct proof of the generality of



a b

Fig. 3. Photomicrographs (magnification of x900). a - coagulate for 8 September 1952; b - coagulate for 30 August 1953.

their origin. Quartz, calcite and horneblend in coagulates were revealed by micromineralogical and X-ray analyses; furthermore, there proved to be a considerable number of smaller, perhaps, amorphous particles, the composition of which is not determined. A certain difference in the composition of the coagulates, which, however, could depend on a somewhat different preparation of the specimens, was revealed. More detailed investigations proved to be difficult due to the very small quantities of materials.* The opalescent violet shading of the filter, obviously, is not only externally similar to atmospheric haze but similar to it in its physical substance. Certain authors do not consider haze an obligatory indicator of a dry wind. But precisely according this indicator, even in the early hours of the day, the local population recognizes the approach of a dry wind. In our observations there was not a case when there would not be haze with a dry wind. Ye. V. Isherskaya [5] arrives at this conclusion

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*The mineralogical and X-ray analyses of specimens were conducted on request of the Institute of Force of the Academy of Sciences of the USSR in the X-ray laboratory of the Soils Institute of the AS of USSR. I express my deep appreciation for this serious help to N. I. Gorbunov, Ye. A. Shuryginaya and N. A. Sharinova. Also I wish to thank V. P. Petrov for the valuable consultations concerning the mineralogical composition of the specimens.

that "there is no noticeable impairment of visibility with dry winds in pilot balloon observations." Such results were obtained, perhaps, owing to the fact that the group of nondry-wind days included days with cloudiness when the illumination of the pilot balloon in the atmosphere is less than 15-20%, and dry-wind days, as a rule, occur with a minimal cloudiness. Furthermore, it is necessary to consider also that on dry-wind days the balloon was projected against a background of a bluish haze, i.e., the contrast of the object and background was somewhat greater than that on usual days.

Much importance in the phenomenon of dry wind is ascribed to the wind. Therefore, conducted in the indicated period were regular observations on the direction and velocity of the wind not only in periods of weather observations, but considerably more frequently, sometimes every 1-2 h. It should be noted that all the dry-wind days fall on the wind direction of southern bearings. Not one case of a dry wind with winds of northern bearings was noted during observations of 1951, 1952 and 1953. In all the dry-wind days without exception, the wind velocity had a sharply marked diurnal variation (Fig. 4a); in the group of intermediate days the diurnal variation proved to be usually somewhat disrupted: the wind was begun or continued during the evening or calmed down during the daytime (Fig. 4b); in all the remaining days the diurnal variation of the wind velocity was the most diverse (Fig. 4c) but was not so correct as on the dry-wind days.

It would be of considerable interest to thoroughly trace the differences in amplitudes of diurnal variation of the temperature and relative humidity of the air on normal and dry-wind days. Selected in the given work for such comparisons (approximate) were 20 dry-wind and normal days each when during the whole day, at least, in the first half of it the sun was not covered by clouds. It was found that on the dry-wind days the air temperature was increased by 90-100% by 1300 h, and the relative humidity was decreased by 60-70% with respect to readings made at 0700 h. On normal days the increase in temperature between those same periods was on the average of 50-60%, and the decrease in relative humidity - by 40-50%. According to data of 1951 it is evident that the larger amplitudes of temperature fall on those

days when the intensity of the direct solar radiation was less; when the intensity of the direct solar radiation was greater, i.e., when the atmosphere was transparent, on those days the amplitude of temperature was less. An increase in the amplitude of temperature and relative humidity depends on the upper (diurnal) limit; at night the temperature and relative humidity are returned usually to the norm. There are cases when after several days of a dry wind the soil temperatures remain somewhat increased (relative humidity - decreased), and they do not return to the "norm": this is indicated by certain "aftereffects" of the dry wind. The characteristics given here can serve only as illustrations. In essence it is necessary to compare the diurnal temperature at a definite altitude of the sun with the temperature, let us assume, during 1-2 h before its rising. The approximate calculations showed that in this case the difference in amplitude on normal and dry-wind days appears still sharper. However, in literature we can encounter directly opposite opinions [7].

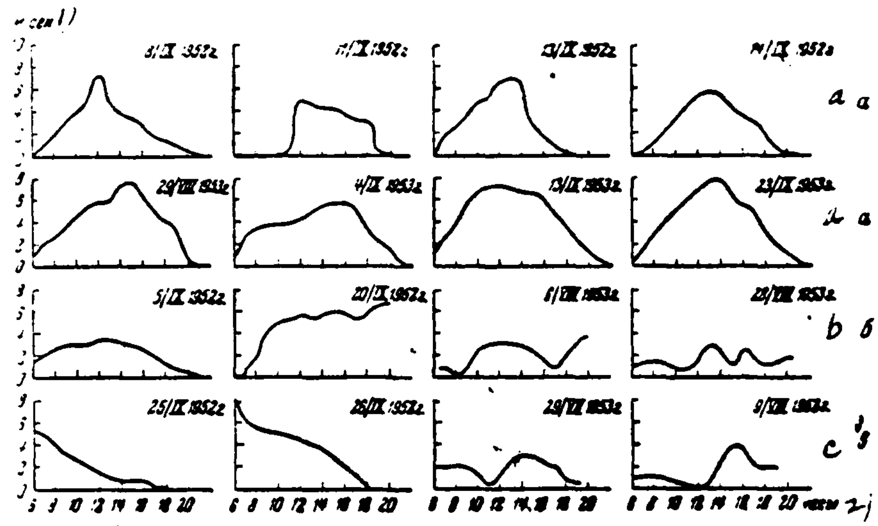

Fig. 4. Diurnal variation of the wind. a - on dry-wind days: 8, 11, 13, and 14 September 1952; 29 August and 4, 13, and 24 September 1953; b - intermediate days: 5 and 20 September 1952; 16 and 25 August 1953; c - normal days: 25 and 26 September 1952; 29 July and 9 August 1953.
Key: 1) m/s; 2) hours.

During 1953 from 15 August to 25 September comparative weather observations were conducted in the field, on the forest meadow, in the forest, and in the thick top of the trees. Placed for these observations at the mentioned stations were wooden towers (in the forest - up to 6 m. i.e., to the middle of the top, on the meadow and in the field - up to 4 m of altitude). Psychrometers were suspended in series every 1 m at all four levels (in the forest - at 6 levels). In order to be able to reduce the observations at different altitudes to one moment of time, they were conducted at all levels at first from below upward and then gradually in the opposite order. Such an order of observations also created the great possibility of revealing random errors. However, there was a certain difference in time in the observations between stations. Results of the observations were presented in the form of a diagram (Fig. 5). The basic conclusions can be formulated briefly as the following:

1) forest meadow (with an area of about 1 ha) with respect to the variation in temperature and relative humidity occupied a middle place between a field and forest: on dry-wind days, with respect to the temperature and humidity of the air, it differed little from the open field, only the wind velocity on it was 2-3 times less;

2) under the canopy of the forest, to an altitude of 2-3 m, the temperature and humidity of the air had a more smooth diurnal variation than that in the field; at midday the air temperature in the forest at a height of 1 m was usually lower than that in the field by 1°-3°, and the relative humidity - by 5-20% more;

3) conditions in the top of the forest on normal and dry wind days were noticeably different; the air temperature in the top on normal days was equal or even slightly higher* than that at the same level above the field, but the air humidity in the top was greater by

*The top of a tree fulfills, apparently, the role of a transformer, which converts a certain portion of the solar radiation into long-wave (3-15 μ), regulating by such means for itself the relationship of intensities of these sections of the spectrum of radiant energy.

5-10%. On dry-wind days the increase in temperature and drop in relative humidity of the air in the top (from 4 m and higher) occurred almost as rapidly as above the field, differing insignificantly with respect to absolute value (Fig. 6). The fact that the dry-wind conditions appear in the forest in the whole layer of the top almost with the same velocity as that in the field deserves special attention. The force itself, perhaps, does not suffer from this, and for it these limits in temperature and relative humidity are probably not "dry-wind," and its resistability is considerably greater. but there appears the question as to how can such a sharp increase in temperature be spread so rapidly to the whole 6-8-meter layer of the top. Heating by direct solar rays of the upper part of the top of the forest occurs on the usual but not the dry-wind days; however, it does not cause such an effect. It is impossible to explain this phenomenon by turbulent mixing of air over the forest, since it occurs on normal days and does not cause such an effect, and the rate of heat propagation by such means in the top of the forest will not be so great. Obviously, it is necessary to seek an explanation to this phenomenon in the fact that with the dry wind the intensity of the intrinsic radiation of the atmosphere, in connection with the large content of dust and high temperature, should be great. The powerful flow of infrared radiation penetrates deeply into the top of the forest and causes a sharp increase in temperature in it. It is necessary to note for the investigation of this phenomenon, it follows to use a pyrgeometer and not a balance meter in order to determine the intensity of flow of radiant energy arriving to the forest top and not the difference in counter flows. For the vegetation, in particular, under conditions of a dry wind, the gentle and total directivity of the radiant field, which is created by the radiation of the sun, atmosphere and underlying surface, is important.*

*We can say even more. Many facts lead to the conclusion that long-wave radiation (8-15 u) is just as important and necessary to the vegetation as is solar radiation. For different forms of vegetation, the different relationships of the solar and long-wave radiation will be optimal. The physical essence of such phenomena as photoperiodism, shade-loving and shade-tolerating, intensity of transpiration, and a number of other phenomena consist in this. The method of "sums of temperatures" of well-known agricultural meteorology, has the same fact as a basis. Investigation of spectral properties of plants in this region of the spectrum would be of great scientific and practical significance.

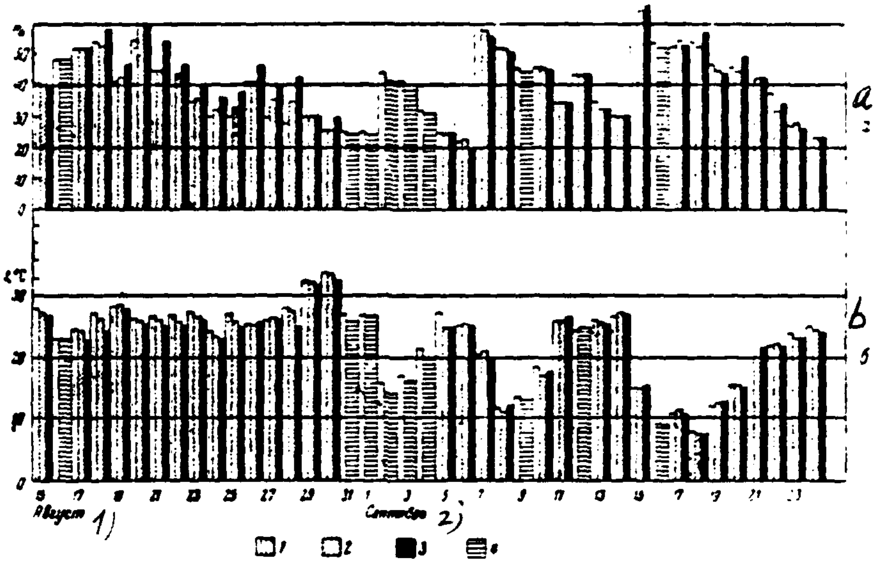

Fig. 4. Comparative variation of diurnal temperatures (a) and relative humidity (b) of air in a field, on a meadow and in the top of a forest at an altitude of 4 m from 15 August 24 September 1953. 1 - field; 2 - meadow; 3 - top of forest; 4 - gaps.
Key: 1) August; 2) September.

The sharp increase with the dry wind of one of these component parts - atmospheric radiation - causes a number of secondary phenomena, as a result of which created is a strong heating up of the whole layer of herbage and forest, the blight of plants occurs, etc. According to investigations of B. N. Ayzenshtat [6], the intensity of the long-wave radiation of the atmosphere Kara-Kum reaches 0.57-0.64 cal/cm^2 with the intensity of the direct solar radiation at 1.25 cal/cm^2. These facts can compel one to reexamine somewhat the viewpoint on the nature of action of the dry wind on a vegetation cover and assume that the dry wind acts on vegetation not just with a direct flow around it. Even if the dry-wind flow is raised above fields to an altitude of several meters by means of forest belts, windbreak strips, etc., then obviously this does not weaken noticeably the harmful effect of the dry wind on vegetation.

All these diverse and, at first glance, separate facts actually are connected by one general cause, and with the exception of it they are difficult to explain. The smallest dust suspended in air transforms a large quantity of radiant solar energy into long-wave radiation (8-15 μ). The air layer containing the dust becomes an

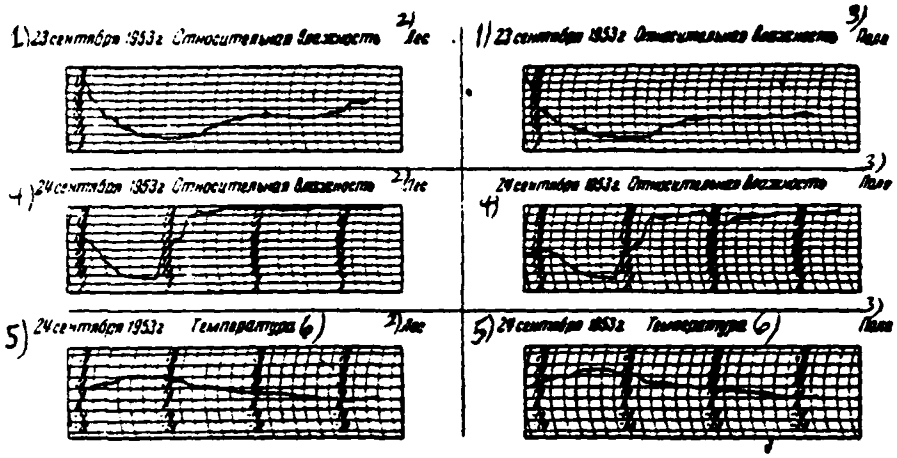

Fig. 6. General view of tapes of recorders in the field and in the top of the forest at an altitude of 4 m (September 1953).
Key: 1) 23 September 1953. Relative humidity; 2) Forest; 3) Field; 4) 24 September 1953. Relative humidity; 5) 24 September 1953, Temperature.

"active layer." This causes a rapid heating up of the air, large amplitudes of temperatures, sharply marked diurnal variation of wind, a rapid heating up of not only enormous expanses of fields but also a forest to considerable depth, a blight of plants, etc. This whole turbulent effect is rapidly ceased after the sun sets.

The contradictory information existing in literature about dry winds points to the assumption that in a number of cases two phenomena are mixed: the dry wind and drought. Both these phenomena appear very sharply in the southeast of the European territory of the Soviet Union, and much is similar in them. However, these are different phenomena. The dry wind is a turbulently occurring phenomenon with a sharply marked diurnal variation in the weather elements, with winds of a definite quadrant of the horizon, and with mist (haze). It can for 1-2 days cause harm to plants even with the presence of sufficient reserves of moisture in the soil, obviously, due to the fact that the plant is not in a state to supply as much water to preserve its tissues from overheating. The drought is created, as is known, by prolonged periods without rain, when reserves of moisture in the soil are greatly reduced. In the period of the drought there can occur winds of different directions, high temperature of the air and soil, low humidity, a smooth diurnal variation of weather elements, and a

diverse cloudiness without haze. Apparently, certain days of such droughts are described as dry winds. The differences between dry winds and droughts were formulated as long ago as in 1935 in the work of Ye. Ye. Fedorov and P. A. Butskiy [8]. Discussed there was a number of very important considerations about dry winds, and an attempt was made to give more definite criteria to the dry wind. The accepted criteria of the dry wind not only of A. A. Kaminskaiy, but also of the Kuybyshev Administration of the Hydrometeorological Service [5] are quite insufficient and actually allow a mixing of the two phenomena, since the conditions determined by them can be not only in the dry winds but also in a drought. In the article "The nature of flying dry winds in the southeast of the European territory of the USSR" [9], P. K. Yevseyev relates several true and important remarks. He takes exception to the opinion that the dry wind occurs as a result of the carrying away of hot air from the middle Asiatic deserts. Similar considerations were already reported [1, 10], but it is useful once more to confirm them. Also important should be considered his remark that "precisely here, in the Caspian Sea low land, and then in the southeast of the European territory of the Soviet Union, air masses acquire dry-wind properties" and that "in the southeast of the European territory of the Soviet Union an independent source of heating of the air exists." The same reference is made in my article, about which P. K. Yevseyev mentions [11, 12], but only in it it is indicated, furhtermore, that the most important factor of the formation of dry-wind air masses is the smallest dust, which arrives abundantly in this region into the air up to considerable altitudes. This is the essence of the positions advanced by me. The different heating up of light soils and chernozems is indicated as a possible reason for the transfer of dry-wind masses from here into other regions. These facts are subject to further refinement, but there are no basis for ignoring them. Very valuable is the remark of P. K. Yevseyev that "dry-winds have a high velocity, which cannot be explained by the ground pressure gradients observed here," and further he attempts to explain this phenomenon by the effect of the underlying surface. Evidently, he did not note that his indication that "in the southwestern part of the anticyclone ... there always blow southeastern and southern winds" is refuted by this correct

remark. Furthermore, dry winds are observed in different positions with respect to the center of the region of high pressure. Quite falsely P. K. Yevseyev evades the fact that in dry-wind periods during the nights there usually is absolute calm. In connection with this, it would be worth recalling also the important fact established by Ye. V. Isherskaya [10] that in the dry winds there exists a counter (northern or northwestern) wind at a level of 5-6 km.

A. I. Voyeykov [13, 14] pointed to the special role of dust in the thermodynamics of the atmosphere exactly in connection with the question of dry winds. In works of I. N. Yaroslavpev [15], Ye. S. Kuznetsov [16], V. A. Bugayev, V. A. Dzhordzhio and V. R. Dubentsov [17, 18], R. N. Aseykin [19], Darst [20], and others it is possible to find many valuable indications to the fact that air impurities create fundamentally different conditions for the heating up of considerable layers of air and have, in certain cases, a predominating importance as compared with the underlying surface. However, the problem of dust in the atmosphere requires still very vast and thorough investigations. It is necessary to draw the general conclusion that a search for the most active means of combatting the dry winds must continue. The oscillation and propagation of varieties of field crops most stable to dry winds is an old measure; however, now it is necessary to consider it one of the most active. Perhaps, no less important would be the creation of a continuous vegetation cover in regions with dusty soils in the Caspian Sea region; apparently, it would be possible to select for these purposes vegetation from the wild perennials, which are capable of transferring unfavorable conditions of those regions; there sowing could be produced by the broadcasting of seeds in early spring from aircraft.

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Forest Institute

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5 May 1954

BIBLIOGRAPHY

1. Zavarina M. V. The problem of the nature of dry winds (Critical survey of literature and bibliography), Trudy Glavnoy geofizicheskoy observatorii im. A. I. Voyeykova, Issue 30 (92), 1951.

2. Naumov V. Khimiya kolloidov [Chemistry of colloids], Edition 3, Gostekhizdat, Leningrad, 1932.

3. Domracheva Ye. A. Fiziko-mekhanicheskiy i khimicheskiy analiz pochvy [Physicomechanical and chemical analysis of soil], Fifth edition, Sel'khozgiz, Moscow-Leningrad, 1939.

4. Gibbs V. Ye. Aerozoli [Aerosols], Goskhimizdat, Leningrad, 1929.

5. Isherskaya Ye. V. Visibility conditions during dry winds, Meteorologiya i gidrologiya, No. 2, 1949.

6. Ayzenshtat B. A. and Zuyev M. V. Certain features of the thermal balance of a sandy desert, Trudy Tashkentskoy geofiz. observ. [Transactions of the Tashkent geophysical observatory], Issue 6, (7), 1952.

7. Kaminskiy A. A. Climate of the plain terrain, Climate of the Voronezh district, part 1, "Novaya Derevnya", Leningrad, 1925.

8. Fedorov Ye. Ye. and Butskoy P. A. Types of weather of dry winds, Zhurnal geofiziki [Journal of geophysics], Vol. 5, No. 3, 1935.

9. Yevseyev P. K. Nature of flying dry winds in the southeast of the European territory of the USSR, Izv. AN SSSR, ser. geofiz., [Bulletin of AS USSR, geophysical series], No. 2, 195[illegible].

10. Isherskaya Ye. V. Problem of the meteorological conditions of a drought and dry winds in the Seratov Volga River region, Uch. zats. Saratovsk. gos. universiteta im. Chernyshevskogo [Scientific notes of the Saratov State University im. Chernyshevskogo], 22, Geographical issue, 1949.

11. Krylov P. A. The problem of dry winds in the Volga River region, Izv. AN SSSR, ser. geofiz. [Bulletin of AS USSR, Geophysical series], No. 5, 1952.

12. Krylov P. A. Dry winds in the southeast of the European part of the USSR, Soobshcheniya kompleksnoy nauchnoy ekspeditsii po voprosam polezashchitnogo lesorazvedeniya [Reports of the combined scientific expedition on problems of windbreak afforestation], Issue 2, 1952.

13. Voyeykov A. I. Mountainous and steppe dry winds, Meteorologicheskiy vestnik [Meteorological Herald], 22, Nos. 8-9, 1912.

14. Voyeykov A. I. Problems in agricultural meteorology, Meteorologicheskiy vestnik No. 9, 1893.

15. Yaroslavtsev I. N. Radiatsionnyy rezhim Tashkenta i nekotorykh

punktov Sredney Azii [Radiation conditions of Tashkent and certain stations of Central Asia], Tashkent, 1949.

16. Kuznetsov Ye. S. On establishing the balance of radiant energy in the absorbing and scattering atmosphere, Izv. AN SSSR, ser. geogr. i geofiz [Bulletin of AS USSR, Geographical and geophysical series], No. 6, 1940.

17. Bugayev V. A., Dzhordzhio V. A., Dubentsov V. R. Thermal effect of dust during dust and sand storms, Izv. AN SSSR, ser. geogr. [Bulletin of AS USSR, Geographical series], No. 3, 1952.

18. Bugayev V. A., Dzhordzhio V. A., Dubentsov V. R. Synoptic conditions of the hottest days in subtropical regions of Central Asia, Trudy Uzbeksk. geogr. ob-va [Transactions of the Uzbek Geographical Society], Issue 1, 1937.

19. Aseykin R. N. Dust as a catalyst of processes of heat exchange between the earth's surface and free atmosphere, Izv. AN SSSR, ser. geogr. i geofiz., No. 1, 1938.

20. Durst C. S. Dust in the atmosphere, Quart. Journ., 61, No. 258, 1935.